

The Effectiveness of Slade 2.0 Game in Increasing the Knowledge of Adolescent Girls about Anemia and Dysmenorrhea

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ABSTRACT

OBJECTIVE: Anemia is an issue of nutritional deficiency that increases mortality and morbidity. Anemia exposes adolescent girls to a variety of fatal risks and vulnerabilities, one of which is dysmenorrhea. Education by improving information about anemia is one of the easiest and cheapest interventions in minimalizing the fatal risk of anemia. The study aims to increase knowledge of video game.

METHODOLOGY: This quasi-experimental design study used a pre-post-test with a control group. Circa 180 adolescent girls in Jakarta and Semarang were recruited using simple random sampling. A smartphone-based concept quiz game developed about anemia and dysmenorrhea information called SLADE (Snakes & Ladders for Anemia & Dysmenorrhea) version 2.0. The feasibility trial of the Game was conducted on 20 respondents. This study compared respondents' knowledge in the intervention and control groups in 2 cities. A control group was given a handout about anemia and dysmenorrhea.

RESULTS: The Wilcoxon ranked test, which was used to compare adolescent girls' knowledge of anemia and dysmenorrhea before and after the Intervention, revealed significant mean differences in both Jakarta ($p = 0.000$; $\alpha = 0.05$) and Semarang ($p = 0.000$; $\alpha = 0.005$). Mann-Whitney's analysis compares mean knowledge differences between the intervention and control groups and shows significant differences ($p = 0.000$; $\alpha = 0.05$).

CONCLUSION: Game SLADE 2.0 significantly increased the adolescent girl's knowledge of anemia and dysmenorrhea between pre-and post-test in the intervention group, as well as between the intervention and control group. Quiz-based models can be developed to improve adolescent girls' knowledge.

KEYWORDS: Anemia, Dysmenorrhea, Game, Adolescent Girls

INTRODUCTION

Anemia is a widespread nutritional issue globally, affecting not only developing countries but also developed nations¹. An estimated 2 billion people suffer from anemia, the highest prevalence in Asia and Africa. The World Health Organization (WHO) has even stated that anemia is among the top 10 health issues in the modern era. High-risk groups for anemia include women of reproductive age, pregnant women, school-aged children, and adolescents².

Anemia is a condition characterized by an insufficient number of red blood cells or inadequate concentrations of oxygen-carrying hemoglobin in the blood to meet the body's physiological needs^{3,4}. According to the 1999 guidelines issued by WHO and the Ministry of Health, cut-off values for anemia vary across different population groups as well as individual categories⁵. The reference cut-off values for anemia are as follows: hemoglobin (Hb) levels below

11.0 g/dL for children aged 12–59 months, Hb levels below 12.0 g/dL for school-aged children aged 6–12 years, Hb levels below 11.0 g/dL for pregnant women, and Hb levels below 12.0 g/dL for women of reproductive age (15–49 years). Meanwhile, males aged ≥ 15 years are considered anemic if their hemoglobin (Hb) levels are below 13.0 g/dL. Certain age groups or individual categories are deemed more susceptible to anemia compared to other⁶.

Anemia in Indonesia, according to the 2013 Basic Health Research (Riskesdas) data, was found in 28.1% of children under five years old with hemoglobin (Hb) levels below 11.0 g/dL, 26.4% of children aged 5–14 years old with Hb levels below 12.0 g/dL, and 37.1% of pregnant women. Anemia is more prevalent in rural areas (22.8%) compared to urban areas (20.6%). A decrease in red blood cells in the blood and iron deficiency characterizes iron deficiency anemia. Compared to men, women are more likely to experience iron deficiency anemia due to the monthly blood loss associated with normal menstruation. Women with iron deficiency anemia are also more likely to experience heavier menstrual bleeding. Most women do not experience symptoms during their menstrual period. However, some may feel pelvic pressure or suffer from pain (dysmenorrhea). Painful menstruation, such as lower abdominal cramps disrupting daily activities, is commonly experienced by adolescents, particularly school-aged teenagers with high levels of physical

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activity⁷.

According to the World Health Organization (WHO), menstrual pain is widespread worldwide. Ninety percent of people have dysmenorrhea, with 1,769,425 people having severe dysmenorrhea⁸. In every nation, menstrual pain affects over 50% of women on average. Between 45 and 90 percent of women in the US are thought to experience menstrual pain. Around 92% of teenagers are said to experience menstrual pain, whereas 90% of women under the age of 19 and 67% of women over the age of 24 in Sweden are said to experience menstrual pain. In Indonesia, 64.25% of women experience dysmenorrhea, with primary dysmenorrhea accounting for 54.89% and secondary dysmenorrhea for 9.36% of cases. Sixty to seventy-five percent of teenagers suffer from primary dysmenorrhea; of those, three-quarters report mild to severe pain, and one-quarter report severe pain. 30% to 50% of women of reproductive age experience dysmenorrhea, according to US research, and 10% to 15% of them miss out on employment opportunities, interfere with their family lives, and disrupt their academic schedules. In a similar vein, although dysmenorrhea is relatively common in Indonesia, only 1% to 2% of women seek medical attention for it⁹.

Indonesia, research conducted by the Center for Information and Counseling on Adolescent Reproductive Health (PIK-KRR) reports a primary dysmenorrhea prevalence of 72.89% and a secondary dysmenorrhea prevalence of 27.11%. The incidence of dysmenorrhea among women of reproductive age ranges from 45% to 95%. Dysmenorrhea causes 14% of adolescents to suffer from skipping school and abstaining from daily activities frequently⁸.

The most common symptom of dysmenorrhea experienced by adolescents is a feeling of stiffness or cramping in the lower abdomen. This discomfort can be severe, leading to irritability, heightened sensitivity, nausea, vomiting, weight gain, bloating, back pain, headaches, acne, tension, fatigue, and depression¹⁰.

These symptoms typically occur one day before the onset of menstruation and persist for two days until the end of the menstrual period. According to the research by Parker MA et al., several psychological disturbances were reported, including 73% feeling angry, 65% experiencing depression, 52% feeling deeply sad, 32% feeling overwhelmed, and 25% wanting to hide. In addition, other symptoms associated with dysmenorrhea, as reported by Novia and Puspitasari (2008), include lower abdominal pain (38.3%), thigh pain (12.57%), nausea (5.98%), dizziness (10.78%), lower back pain (23.3%), pain in the back of the legs (5.98%), diarrhoea (1.2%), constipation (1.2%), and fainting (0.6%).

According to the research by N. Karout et al. (2012), 19.3% experienced mild dysmenorrhea, 60.3% moderate dysmenorrhea, and 20.2% severe dysmenorrhea. The findings revealed that most respondents experienced abdominal pain radiating to the thighs. Dysmenorrhea prevented 59.4% of women

from performing daily activities, while 33.3% reported occasional disruptions to their activities. Additionally, 8.5% of female students missed school due to the pain experienced during their menstrual periods.

Research by Wahyuningsih et al. (2014) titled "*The Relationship Between Hemoglobin Levels and the Incidence of Dysmenorrhea Among 11th-Grade Students at SMA Negeri 1 Wonosari Klaten*" found that most respondents with low hemoglobin levels experienced dysmenorrhea. Specifically, 11 respondents (27.5%) with low hemoglobin levels experienced dysmenorrhea, while one respondent (2.5%) did not. Among respondents with high hemoglobin levels, 4 (10.0%) experienced dysmenorrhea, and 2 (5.0%) did not^{11,12}.

One approach to addressing anemia and dysmenorrhea is through education. Education in this context serves as an effort to bring about change by enhancing the knowledge and attitudes of adolescent girls regarding anemia. Adolescents represent a strategic group for preventing anemia and dysmenorrhea through educational initiatives, as they are still in the learning phase, making them more receptive to acquiring knowledge. Knowledge or cognition is a domain that shapes an individual's actions. The use of media supports educational efforts aimed at improving the knowledge of adolescent girls^{13,14}.

The medium used is video games. Media is crucial in enhancing adolescent girls' knowledge by delivering information effectively. Media offers several advantages, including transforming abstract and complex concepts into concrete, simple, systematic, and clear¹⁵. The use of games, particularly video games, as a learning medium for adolescent girls is considered highly effective in fostering their interest in acquiring knowledge because video games are easy to play, and the intrinsic nature of children is their love for play. Games provide educational entertainment, as they serve as a medium through which children learn. Video games can create engaging learning activities and contribute to a pleasant, lively, and relaxed learning environment. Therefore, video games represent an alternative medium that can be utilized in cooperative learning¹⁶.

An Android-based educational video game is a mobile game designed to provide creative and communicative information about anemia and dysmenorrhea to adolescent girls. Educational games are utilized as learning media because they can create engaging, dynamic, enjoyable, and relaxed teaching and learning activities. Moreover, they actively involve adolescent girls in receiving information, enhancing their understanding¹⁷.

This study aimed to determine whether or not Android-based video games enhanced adolescents' knowledge about anemia and dysmenorrhea. Similar research has not been found, making this study a potential reference for future approaches to managing anemia and dysmenorrhea in adolescent girls in the

era of digitalization.

METHODOLOGY

Study Design, Population, and Sample

This study employed a quantitative research approach with a quasi-experimental design, specifically a randomized post-test with a control group design. This approach aims to determine whether there is a change in a condition that is strictly controlled by providing treatment using a comparison group. The researchers tested an intervention on a group of subjects by comparing the effects of the treatment on the intervention group with those in a control group (which received a handout on anemia and dysmenorrhea). This study is a pilot study because there has never been a study that has tested the SLADE 2.0 Game on the knowledge of girls and adolescents about anemia and dysmenorrhea. The pilot study's sample size was 10-40 respondents per group. This study divided respondents into control and intervention groups, which were carried out randomly. The population in this study consisted of adolescent girls in two cities (Jakarta and Semarang) who had experienced menstruation and owned an Android smartphone.

Instrument

The researcher developed an Android-based educational game about anemia and dysmenorrhea. The SLADE game (Snake and Ladder for Anemia and Dysmenorrhea) version 2.0 is a creative and communicative quiz game featuring a snakes-and-ladders setup, enhanced with quiz questions and additional features integrated into the gameplay. This Game has passed copyright testing by the Ministry of Law and Human Rights, with Intellectual Property Rights Certificate No. EC00202488349. The research instrument for assessing adolescent girls' knowledge of anemia and dysmenorrhea was created as a Google Forms questionnaire consisting of 32 multiple-choice quiz questions with four answer options and only one correct answer. The instrument underwent validity testing, showing an r-value range of 0.696 to 0.997 and a Cronbach's alpha value of 0.986 among 30 adolescent girls with characteristics similar to those of the study respondents in Jakarta.

Data Analysis

This analysis was conducted using nonparametric testing, specifically the Mann-Whitney test, due to the non-normal distribution of the population. The Mann-Whitney test was used to compare the mean knowledge scores between the intervention group, which utilized the SLADE 2.0 game, and the control group, provided with a leaflet. The Wilcoxon rank test was employed for the two intervention groups to identify the difference in average scores in the two cities (Jakarta and Semarang) within the intervention group before and after the Intervention. The Wilcoxon test was chosen due to the non-normal distribution of the data.

Ethical permission: This study refers to ethical

principles, starting from proposal to publication. This study has passed the ethical review with Ethical Review Letter KEPK/UMP/86/VIII/2024 by the Ethics Commission of Universitas Muhammadiyah Purwokerto, Indonesia.

RESULTS

Table I presents the percentage distribution of knowledge among adolescent girls (%). In Jakarta, teenage girls had an average knowledge score of 65% before the Intervention and 94% after the Intervention. In Semarang, knowledge scores were 52% (pre-intervention) and 85% (post-intervention). The summary for both cities indicated an average of 58% before the Intervention and 88.5% afterwards.

Table II highlights the effect of Game SLADE 2.0, showing a significant improvement among 90 respondents. The Wilcoxon rank test in Jakarta yielded a p-value of 0.000 ($p < 0.05$) with a Z score of -5.848. Similarly, the p-value in Semarang was 0.000 ($p < 0.05$) with a Z score of 0.000. These results indicate that Game SLADE 2.0 effectively enhances the knowledge of adolescent girls about anemia and dysmenorrhea in two cities in Indonesia.

Table III shows a significant difference in the average knowledge of adolescent girls about anemia and dysmenorrhea between the intervention and control groups in both cities. There is a substantial difference between Game SLADE 2.0 and the control group, with a p-value of 0.000 ($p < 0.05$). The mean rank for the intervention group (Game SLADE 2.0) is 124.4, higher than the control group, with a mean rank of 56.50.

Table I: Distribution of Adolescent Girls' Knowledge (n=180)

City	Before Intervention(%)	After Intervention(%)
Jakarta	64%	92%
Semarang	52%	85%
Both	58%	88,5%

Table II: The Effect of Game Slade 2.0 on Adolescent Girls' Knowledge in Jakarta and Semarang (n=90)

	SLADE 2.0 Game groups in Jakarta (n=45)	SLADE 2.0 Game groups in Semarang (n=45)
Z	-5,848	-5,722
P Value	0,000	0,000

Table III: The Effect of Game Slade 2.0 on Adolescent Girls' Knowledge (n=180)

Variable	Intervention Group (n=90)	Control Group (n=90)	P value
Mean Differences in Adolescent Girls' Knowledge about anaemia & dysmenorrhea	124,40	56,50	0,000

DISCUSSION

Anemia, particularly iron deficiency anemia, is commonly experienced by adolescent girls in cities such as Jakarta and Semarang. The issue of iron deficiency anemia is not solely caused by insufficient food intake. Many adolescents are unaware of the healthy foods that should be consumed to support their growth and development. Lack of knowledge about anemia, including its causes and management, leads to cases of anemia among adolescent girls, often resulting in more severe symptoms and exacerbating conditions such as dysmenorrhea during menstruation.

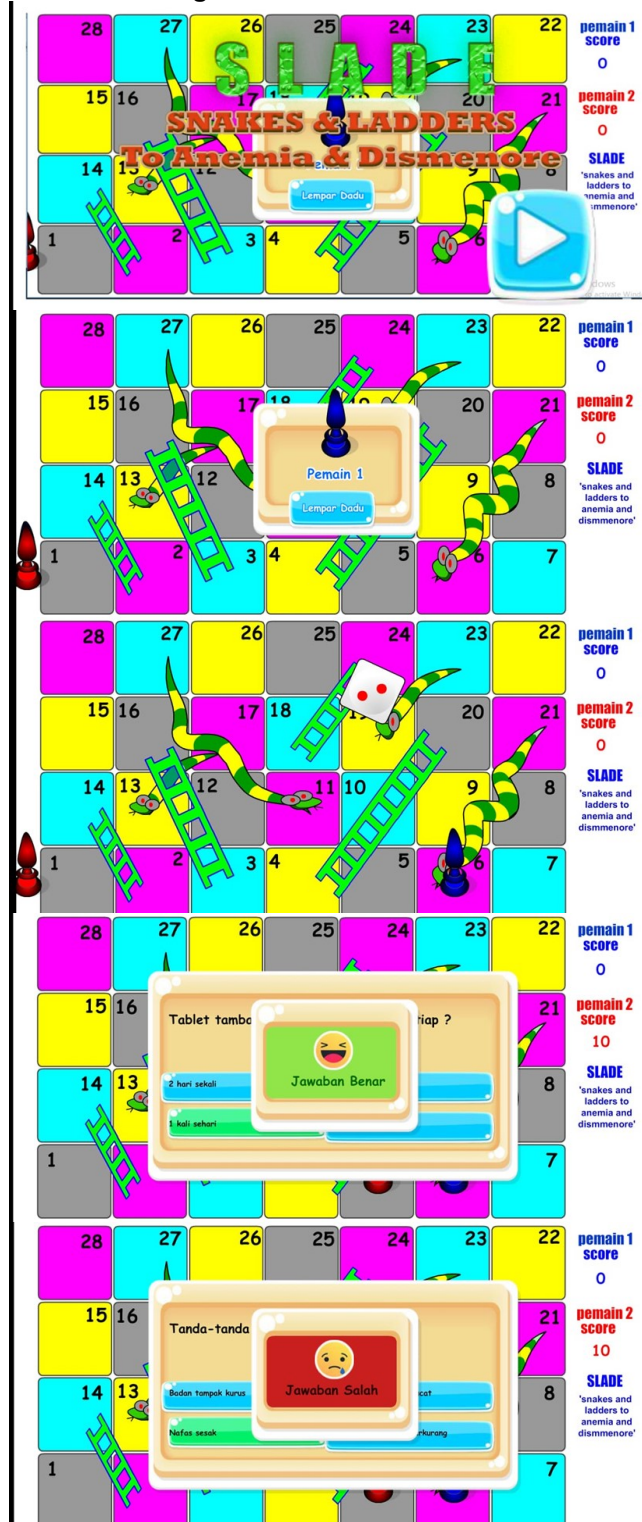
Menstruation is a natural condition in women as part of the reproductive cycle. Some women experience discomfort during menstruation, such as lower back pain, abdominal cramps, body aches and fatigue due to the loss of blood. The discomfort suffered during the menstrual period is known as dysmenorrhea. Each person has a different experience of dysmenorrhea. Women with anemia tend to experience more severe dysmenorrhea due to the lack of oxygen in the uterine lining and increased nerve sensitivity. Contractions become more painful, and heavier bleeding exacerbates the anemia and stress from the inability to withstand the physical pressure and pain. Many women are unaware of the connection between anemia and dysmenorrhea, especially young women who have just started menstruating. This research focuses on developing a Game to enhance the knowledge of adolescent girls about anaemia and dysmenorrhea.

The development of the SLADE 2.0 game aims to enhance the knowledge of anemia and dysmenorrhea among adolescent girls in cities such as Jakarta and Semarang. The concept for the SLADE (Snake Ladder for Anemia and Dysmenorrhea) quiz game version 2.0 is based on information that adolescent girls should know about anemia and dysmenorrhea. The Snake and Ladder game Wibawanto (2020) created was inspired by SLADE game¹⁸. The author proposed the idea of a quiz game focused on enhancing the players' cognitive understanding of anemia and dysmenorrhea to design visual communication¹⁹. The Game combines a quiz theme with a snakes and ladders format, which is then developed into a mobile game for smartphones and hardware devices. Smartphone-based and hardware video games can be played anytime and anywhere. Due to their high popularity, especially among adolescents, mobile games have become a popular choice²⁰.

The SLADE 2.0 game concept uses a modified snakes and ladders format incorporating questions about anemia and dysmenorrhea¹⁶. The questions are designed according to the difficulty level of each stage to challenge players to search for information about anemia and dysmenorrhea to complete the Game. The questions are formulated around the

concepts of anemia and dysmenorrhea, such as definitions, causes, signs and symptoms, potential impacts, complications, and symptom management. Additional game features are incorporated to make the gameplay more engaging and challenging.²¹ The questions developed have undergone validity and

Picture 1: Design of Slade 2.0



reliability testing with 30 adolescent female respondents who had experienced menarche. The r values ranged from 0.696 to 0.994 ($r > r$ table) and the Cronbach's alpha value was 0.986.

This Game is designed for adolescent girls aged 12–18 years, including elementary, middle, and high school students or their equivalents and the general public. The 2.0 version of the Game is developed as a mobile game for smartphones and hardware devices, featuring an educational design and animated visuals to make it more engaging. Additionally, the Game supports multiplayer functionality, allowing more than one player to participate.

The research findings indicate a difference in the mean scores among adolescent girls in Jakarta and Semarang after the Intervention with the SLADE 2.0 Game. In Jakarta, the mean score before the Intervention was 64%, increasing to 92% after the Intervention, with a knowledge score improvement of 28%. Adolescent girls in Semarang had a lower mean than those in Jakarta, with a pre-intervention score of 52% and a post-intervention score of 85%, reflecting a 23% increase in knowledge. Jakarta's status as the capital city and government centre facilitates more straightforward access to information. Adolescent girls in Jakarta had greater access to information as they sought it through smartphones and social media. All respondents in Jakarta owned personal smartphones and social media accounts, which they frequently used to search for information, particularly health-related topics.

The Wilcoxon ranking test results for each city showed a p -value of 0.000 ($p < 0.05$), indicating a significant effect of the SLADE 2.0 Game on adolescent girls' knowledge about anemia and dysmenorrhea. A comparison of the mean values between the SLADE 2.0 Game intervention group and the control group, which received handouts, also yielded a p -value of 0.000 ($p < 0.05$). This signifies a significant difference between the two groups, with the intervention group having a mean score of 124.4, compared to 56.50 in the control group.

The SLADE 2.0 Game effectively enhances adolescent girls' knowledge about anemia and dysmenorrhea due to the following factors:

1. Learning Through Play (Edutainment)

The SLADE 2.0 Game, modified with educational content on anemia and dysmenorrhea, enables adolescents to learn while playing. This interactive approach creates an enjoyable and engaging environment, preventing boredom and facilitating better absorption of information about anemia and dysmenorrhea. When learning is associated with positive experiences, adolescent girls are more motivated to understand the material being presented.

2. Gradual Delivery of Information

The SLADE 2.0 Game is designed to allow players to progress step-by-step from one square to the next, with each square containing questions, facts,

or explanations about anemia and dysmenorrhea. This approach enables information to be absorbed gradually and systematically, preventing adolescents from feeling overwhelmed. The incremental learning process fosters a slow yet profound development of their knowledge about anemia and dysmenorrhea.

3. Motivation through Challenges and rewards

The SLADE 2.0 Game encourages players to progress by introducing challenges and rewards, such as climbing ladders for correct answers or minor penalties, like losing points for incorrect ones. This system fosters motivation to retain information about anemia and dysmenorrhea to succeed in the Game. Such motivation enhances adolescent girls' engagement in the learning process.

4. Facilitating Discussion and Collaboration

The Game is often played in groups, allowing adolescent girls to engage in discussions or share knowledge about anemia and dysmenorrhea. This collaborative environment enables them to learn from one another, reinforcing their understanding of these health topics through social interaction. Group play enhances knowledge retention and fosters teamwork and communication skills, making learning more dynamic and engaging.

5. Reinforcement Through Repetition

Each time players replay the SLADE 2.0 game, they encounter the same information, whether through questions or facts related to anemia and dysmenorrhea. This repetition reinforces their memory and deepens their understanding of the material. By revisiting the content multiple times in an interactive and engaging format, players are more likely to retain critical knowledge, ensuring long-term comprehension of these essential health topics.

6. Active Engagement

SLADE 2.0 Game encourages players to actively participate by answering questions and following instructions in each box. This active involvement fosters greater focus on the learning process and enhances the likelihood of retaining for longer. Players develop a deeper understanding and better recall of these critical health concepts by engaging directly with content related to the signs, symptoms, and treatment of anemia and dysmenorrhea.

CONCLUSION

SLADE 2.0 Game enhances the knowledge of adolescent girls in large cities. With an interactive, enjoyable, game-based approach, SLADE 2.0 Game is an effective tool for increasing awareness about anemia and dysmenorrhea. By combining education with entertainment, this Game makes the learning process more engaging and meaningful for adolescent girls.

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AUTHOR CONTRIBUTION

Trianingsih D: Study supervision, data collection, manuscript writing, concept of study and game model
Maryati: Critical revisions for important intellectual content, study supervision, data collection, SPSS data
Andriana N: Data collection, references, manuscript writing, data collection, SPSS data

Diba F: Critical revisions for important intellectual content

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